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## NOTES ON THE CLADONIAE OF CONNECTICUT<sup>1</sup>

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THE writer's report on the Cladoniae of Connecticut,<sup>2</sup> published in 1930, was based on collections made in various parts of the State down to the close of 1928. In the preparation of this report valuable help was obtained from Mr. C. A. Robbins, of Onset, Massachusetts, who determined most of the material and made observations on many of the more critical specimens. Since 1928 the exploration for Cladoniae in Connecticut has been continued, and the present paper, which represents a supplement to the earlier report, summarizes the results of these explorations down to the close of 1931.

Since the death of Mr. Robbins in 1930 the writer has been fortunate in securing the kind coöperation of Dr. Heinrich Sandstede, of Bad Zwischenahn, Oldenburg, the leading authority on the genus Cladonia. Dr. Sandstede has not only determined a number of puzzling specimens but has also given his opinion on several problematical species and forms. The writer would here express to Dr. Sandstede his grateful appreciation.

Two important works on Cladonia, which have a more or less direct bearing on the Connecticut species, were published in 1931. The first of these is Sandstede's beautifully illustrated volume in the Rabenhorst Flora.<sup>3</sup> This gives the most recent views on the various species and forms of Europe and is especially noteworthy for the critical remarks on the specimens distributed in the author's

<sup>1</sup> Contribution from the Osborn Botanical Laboratory.

<sup>2</sup> Trans. Connecticut Acad. 30: 357-510. 1930.

<sup>3</sup> Die Gattung Cladonia. In Rabenhorst, Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz 9, Abt. 4<sup>2</sup>: 1-531. pl. 1-34. Leipzig, 1931.



Cladoniae Exsiccatae. All but 12 of the Connecticut species are figured. The second work is the paper by Robbins and Blake on the Cladoniae found in the vicinity of Washington.<sup>4</sup> This paper lists 36 species and gives keys for their determination. The figures include illustrations of 30 species represented in the Connecticut flora.

The writer's 1930 report listed 45 species for Connecticut, represented by 163 forms. Subsequent study has yielded 5 additional species but has eliminated *C. foliacea*, which was reported on insufficient evidence. This gives a total of 49 species for the State, and these are now represented by 200 forms. The present paper lists the additions that have been made for the State as a whole and for individual towns and also revises some of the older records. This revision involves a few incorrect or doubtful determinations but is mainly due to newer concepts regarding the definition of certain species and forms. The sequence followed is the same as in the 1930 report and all page-references, unless otherwise indicated, relate to this report. Species and forms reported for the first time from Connecticut are marked with asterisks, even where the specimens in question have been previously reported under different names. Stations listed with dates alone refer to specimens collected by the writer; all other stations are listed with both dates and collectors' names. Specimens from all the stations listed are preserved in the herbarium of Yale University.

#### Subgenus CLADINA

CLADONIA RANGIFERINA (L.) Web. (p. 375). Granby (*Musch & Evans*, 1930), Lyme (1930), Suffield (*Musch & Evans*, 1930), Wallingford (1931), and Winchester (1931).

CLADONIA RANGIFERINA f. CRISPATA Coem. (p. 377). Winchester (1931, det. Sandstede).

CLADONIA RANGIFERINA f. PROLIFERA Flot. (p. 377). Stamford (1928, det. Sandstede, not previously reported).

\*CLADONIA RANGIFERINA f. TENUIOR (Del.) Mass. Sched. Crit. 115. 1855 (as variety); Olivier, Fl. Lich. de l'Orne, etc. 38. 1882 (as form). *Cenomyce rangiferina* var. *tenuior* Del. Lich. France 20. 1828; in Duby, Bot. Gall. 621. 1830.

On sandy soil, North Branford (1931, det. Sandstede). First record for North America.

The colonies of *f. tenuior* are composed of low, slender, richly branched podetia and tend to be small and rounded. Sandstede

<sup>4</sup> Cladonia in the District of Columbia and vicinity. RHODORA 33: 145-159. pl. 210-212. 1931.



suggests that the form may perhaps represent a juvenile condition of normal *C. rangiferina*.

CLADONIA SYLVATICA (L.) Hoffm. (p. 378). North Branford (1931), Old Saybrook (1931), and Winchester (1931).

CLADONIA SYLVATICA f. PYGMAEA Sandst. (p. 381). Lyme (1930, det. Sandstede).

CLADONIA SYLVATICA f. PROLIFERA Sandst. (p. 381). Wilton (1931).

CLADONIA MITIS Sandst. (p. 383). Lyme (1930) and Wilton (1931).

CLADONIA MITIS f. PROLIFERA Sandst. (p. 383). Wallingford (1931).

CLADONIA TENUIS (Floerke) Harm. (p. 384). Barkhamsted (1928, det. Sandstede, listed on p. 387 as *C. impeza* f. *laxiuscula*, not new to the town), Essex (1931), Granby (*Musch & Evans*, 1930), Kent (1931), Lyme (1930), Middlebury (*Musch & Evans*, 1929), Milford (1931), Wallingford (1931), and Wilton (1931).

\*CLADONIA TENUIS f. SETIGERA Sandst. in Rabenhorst, *Kryptogamen-Flora* 9, Abt. 4<sup>2</sup>: 52. 1931.

On earth in fields and open woods. Essex (1931, first collection for Connecticut), Lyme (1931), and Madison (1931), all determined by Sandstede. New to North America.

The podetia of f. *setigera* produce pale, hair-like appendages, which often become blackish with age. According to Sandstede's account they sometimes occur at the tips of branchlets bearing spermagonia and sometimes spring from the sides of the podetia.

\*CLADONIA TENUIS f. PROLIFERA Sandst. in Rabenhorst, *Kryptogamen-Flora* 9, Abt. 4<sup>2</sup>: 52. 1931.

On earth in a field, Newtown (1928, det. Robbins, not previously reported). New to North America.

This form shows short, adventive outgrowths, springing from the sides of old prostrate podetia. It is analagous to the proliferous conditions of the three preceding species.

#### Subgenus PYCNOTHELIA

CLADONIA PAPILLARIA (Ehrh.) Hoffm. f. MOLARIFORMIS (Hoffm.) Schaer. (p. 390). East Haven (1931), Essex (1931), Hamden (1931), North Branford (1931), Old Saybrook (1931), and Wallingford (1931).

CLADONIA PAPILLARIA f. STIPATA Floerke (p. 391). North Branford (1931) and Wilton (1931).

CLADONIA PAPILLARIA f. PAPILLOSA Fr. (p. 391). East Haven (1931), Essex (1931), Hamden (1931), Old Saybrook (1931), and Wallingford (1931).

\*CLADONIA PAPILLARIA f. EPISTELIS Sandst. in Rabenhorst, *Kryptogamen-Flora* 9, Abt. 4<sup>2</sup>: 88. 1931.

On sandy soil, Wilton (1931, det. Sandstede). New to North America.



In this form, which was based on specimens collected in Baden by Braun, the apothecia arise directly from the sides of the podetia, instead of being borne on the tips of definite branchlets.

\*CLADONIA PAPILLARIA f. PROLIFERA (Wallr.) Schaer. Enum. Crit. Lich. Europ. 265. 1850. *Patellaria coccinea* b. *molariformis*  $\beta$ . *prolifer* Wallr. Naturg. Säulch. Flecht. 172. 1829.

On sandy soil, North Haven (1931). Not before reported from North America.

This form is analagous to the proliferous states found in the subgenus *Cladina*. It is characterized by the presence of adventive branches springing from the sides of the podetia and may arise when normal development is disturbed by mechanical or other factors. The adventive branches are sometimes simple and papilliform and sometimes sparingly subdivided.

### Subgenus CENOMYCE

#### Section COCCIFERAE

##### Subsection SUBGLAUDESCENTES

CLADONIA FLOERKEANA (Fr.) Floerke var. INTERMEDIA Hepp (p. 393). Lyme (1931), North Branford (1931), Wallingford (1931), and Winchester (1931).

CLADONIA FLOERKEANA var. CARCATA (Ach.) Vainio (p. 394). Essex (1931), Greenwich (1931), Lyme (1931), North Branford (1931), Old Lyme (1930), and Wilton (1931).

CLADONIA FLOERKEANA var. CARCATA f. SQUAMOSISSIMA (Th. Fr.) Vainio (p. 394). Essex (1931), North Branford (1931), and Wilton (1931).

CLADONIA BACILLARIS (Ach.) Nyl. (p. 395). Essex (1931), Fairfield (1931), Lyme (1931), Milford (1931), Old Lyme (1930), Suffield (*Musch & Evans*, 1930), Wallingford (1931), and Wilton (1931).

CLADONIA BACILLARIS f. CLAVATA (Ach.) Vainio (p. 397). North Branford (1931), North Haven (1931), Old Lyme (1930), and Old Saybrook (1931).

CLADONIA BACILLARIS f. PERITHEA (Wallr.) Arn. (p. 397). Old Lyme (1930).

CLADONIA BACILLARIS f. REAGENS Evans (p. 397). Cornwall (1931), North Haven (1931), and Old Saybrook (1931).

\*CLADONIA BACILLARIS f. ABBREVIATA (Vainio) Harm. Lich. France 336. 1907. *C. bacillaris* var. *abbreviata* Parrique, Actes Soc. Linn. Bordeaux 59: 115. 1904. *C. bacillaris* m. *abbreviata* Vainio in Parrique *l. c.* (as synonym).

On tree bases. Guilford (1926, not previously reported) and Old Saybrook (1931, det. Sandstede). New to North America.



According to Harmand f. *abbreviata* is distinguished by its very short, strongly soresiose podetia and by its small, incised-crenulate primary squamules, which are likewise soresiose, sometimes so strongly so that they become transformed into soresidia and give the thallus a powdery appearance.

\*CLADONIA BACILLARIS f. SOREDIATA Sandst. in Rabenhorst, Kryptogamen-Flora 9, Abt. 4<sup>2</sup>: 106. 1931.

On an old log, Old Saybrook (1931, det. Sandstede). The first record for North America.

In the present form the development of soresidia is unusually exuberant, so that more or less elevated masses are sometimes formed. These are usually situated on the primary squamules but may be on the podetia.

CLADONIA MACILENTA Hoffm. f. STYRACELLA (Ach.) Vainio (p. 399). Essex (1931), North Branford (1931), North Haven (1931), Wallingford (1931), and Winchester (1931).

CLADONIA MACILENTA f. GRANULOSA Aigret (p. 400). Wallingford (1931).

\*CLADONIA MACILENTA f. SQUAMIGERA Vainio, Acta F. et Fl. Fennica 4: 109. 1887 (as *C. macilenta* \* $\beta$ . *squamigera*); Harmand, Bull. Soc. Sci. Nancy II. 14: 341. 1895 (as variety).

On an old stump, Wallingford (1931). Not before recorded from North America.

The podetia of f. *squamigera* are soresiose, much as in f. *styracella*, but are distinguished by being more or less squamulose throughout, even in close proximity to the apothecia.

\*CLADONIA DIDYMA (Fée) Vainio, Acta Soc. F. et Fl. Fennica 4: 137. 1887. *Scyphophorus didymus* Fée, Ess. Crypt. Ecorc. Exot. Off. xcvi, pl. 3, f. 13. 1824. *Cladonia pulchella* (Schwein.) Fr. Lich. Eur. Ref. 232. 1831 (*nomen nudum*); Tuckerman, Am. Jour. Sci. Arts 25: 427. 1858.

On logs, stumps, rocks, and soil rich in humus, sometimes growing with mosses.

The species has a wide distribution, especially in tropical regions. It has been reported from various parts of South America, extending from Colombia to Chile; from several islands of the Pacific; from Australia; from Java and Ceylon; and from the Comoro Islands and Réunion in the Indian Ocean. In North America it is known from Mexico and the West Indies northward in the eastern United States as far as Massachusetts, where Willey found it in the vicinity of New Bedford.<sup>5</sup> In 1927 the writer reported it from Connecticut<sup>6</sup>

<sup>5</sup> See Vainio, Acta Soc. F. et Fl. Fennica 10: 444. 1894.

<sup>6</sup> RHODORA 29: 100. 1927.



but afterwards showed (p. 397) that this record was based on specimens of *C. bacillaris*. The specimens listed below, therefore, represent the first authentic reports for the State.

In certain respects *C. didyma* is related to *C. Floerkeana*, *C. bacillaris*, and *C. macilenta*. All four species are characterized by well-developed primary squamules, which show no indication of stramineous coloration, and by cupless podetia tipped with red apothecia; in most cases the podetia are simple or sparingly branched, although more copiously branched forms are occasionally developed.

Both the primary squamules and the podetia, however, yield distinctions of importance. In *C. didyma* the squamules, which are narrow and relatively thin, do not produce soredia and are deeply lacinate, incised, or crenate. In the other three species the squamules are broader and thicker, their marginal indentations are shallower, and they usually produce soredia in greater or less abundance, even if squamules without soredia occasionally occur. The differences in the podetia are still more striking. In *C. didyma* the podetial surface is at first covered over with scattered or crowded squamules, verruculae, or granules, sometimes interspersed with fine soredia. These structures, however, which represent the outer medullary layer (and in most cases the cortex as well), tend to disappear more or less completely and leave the well-developed cartilaginous layer of the medulla exposed. This layer presents a translucent appearance, whitish at first but usually turning yellowish or brownish with age. In the other three species the podetial surface is usually densely sorediose, either wholly or in part, and when green tissues are present they form flat green areas rather than verruculae or granules. After the disappearance of the soredia the denuded surface appears opaque, white, and more or less rough or even arachnoid, owing to the persistence of the loosely interwoven hyphae of the outer medullary layer. It is only in very old and weathered specimens that the cartilaginous layer is exposed.

There is perhaps a slight danger of confusing *C. didyma* with *C. cristatella*, especially with forms in which a stramineous tinge is scarcely apparent. In *C. cristatella*, however, the podetial surface is neither granular nor sorediose, and the portions not covered over with the green outer layer are white and opaque. The closely related *C. incrassata* agrees with *C. didyma* in showing translucent and often darkened areas on old podetia, but this species is at once dis-



tinguished by its yellowish primary squamules, which usually produce soredia in abundance.

Vainio recognized two varieties of *C. didyma*: var. *muscigena* (Eschw.) Vainio, which is negative with KOH, thus agreeing with *C. Floerkeana* and *C. bacillaris*; and var. *vulcanica* (Zolling.) Vainio, which gives a yellow reaction with KOH, thus agreeing with *C. macilenta*. Shortly before his death Mr. Robbins expressed the opinion that the second variety, which is unknown in Connecticut, ought to be recognized as a valid species under the name *C. vulcanica* Zolling., and this seems to be a reasonable course to follow. The var. *muscigena* could then be considered a simple synonym of *C. didyma* or else be given formal rank. The Connecticut specimens of the species are referable to the following forms:

\*CLADONIA DIDYMA f. SUBULATA Sandst. Clad. Exsic. 1685. 1927 (as modification).

On logs and stumps. Lyme (1931, first collection for the State), Madison (1931), and North Branford (1931). The specimens were determined by Sandstede.

The original specimens of f. *subulata* were collected by S. Rapp at Sanford, Florida, and agree in all essential respects with the Connecticut specimens. In his description of the form, Sandstede calls attention to the pointed, translucent, and decorticate podetia, which are almost always sterile.

\*CLADONIA DIDYMA f. **squamulosa** Robbins, f. nova, podetia in omnibus partibus squamulosa.

On logs and stumps. Lyme (1931, first collection for Connecticut) and North Branford.

Robbins applied the name "*squamulosa*" to various specimens from the South; these are mostly a little more robust than the Connecticut specimens but are otherwise in agreement. The squamules present, which vary considerably in number and in size, are very much like the primary squamules.

#### Subsection STRAMINEO-FLAVIDAE

CLADONIA PLEUROTA (Floerke) Schaer. (p. 400). Middlebury (*Musch & Evans*, 1929), North Branford (1931), Old Saybrook (1931), Suffield (*Musch & Evans*, 1930), Wilton (1931), and Winchester (1931).

CLADONIA PLEUROTA f. DECORATA Vainio (p. 402). Essex (1931) and Old Saybrook (1931).

\*CLADONIA PLEUROTA f. CERINA (Nagel) Oliv. Mém. Soc. Sci. Nat. Math. Cherbourg 36: 119. 1907 (as variety); Sandstede in Rabenhorst, Kryptogamen-Flora 9, Abt. 4<sup>2</sup>: 147 (as form). *C. cerina* Nagel in



Rabenhorst, Lich. Eur. Exsic. 303. 1857; Ohlert, Schr. Königl. Physikal.-Oeconom. Ges. Königsberg. 4: 16. 1863. *C. coccifera* \*ε. *cerina* Vainio, Acta Soc. F. et Fl. Fennica 4: 172. 1887; Zahlbruckner, Cat. Lich. Univ. 4: 465. 1926 (as variety). *C. pleurota* f. *pallescens* Evans, Trans. Connecticut Acad. 30: 402. 1930.

On earth, usually in old fields or over rocks. East Haven (1931), Essex (1931), Lyme (1931), Old Saybrook (1931), and Wallingford (1931). Other stations have been reported under f. *pallescens* (p. 403).

The writer's f. *pallescens* was based on specimens with small yellowish bodies borne on the margins of the cups. These bodies were interpreted as aborted apothecia. Sandstede, however, expressed the opinion (*in litt.*) that they were conidial conceptacles or spermatogonia instead and that f. *pallescens* was really the spermatogonial state of f. *cerina*. In most of the plants examined the bodies in question failed to show definite reproductive structures, but a few were clearly spermatogonial in character. Sandstede's view that the plants should be referred to f. *cerina* is supported by Vainio's statements regarding the similarity in color between the apothecia and spermatogonia in the Cocciferae.<sup>7</sup> When the apothecia show the characteristic red color, according to his account, the same color appears in the spermatogonia, although it may be restricted to the parts surrounding the orifice; when, on the contrary, the apothecia are pale, the spermatogonia also are pale, at least in part. The apothecial state of f. *cerina* has been found in Maryland by Blake.<sup>8</sup>

CLADONIA PLEUROTA var. FRONDESCENS (Nyl.) Oliv. (p. 403). North Branford (1931).

\*CLADONIA PLEUROTA f. ALBIDA Vainio, Acta Soc. F. et Fl. Fennica 53<sup>1</sup>: 38. 1922.

On rock in pasture, North Branford (1931, det. Sandstede). New to North America.

The podetia of f. *albida* are more whitish than in the usual forms of the species and sometimes show a vague bluish tint. When KOH is added a distinct yellowish reaction is obtained. The soredia are often coarsely granular. The form was described from specimens collected in Finland, but Sandstede cites it also from Czechoslovakia and Germany.

CLADONIA CRISTATELLA Tuck. (p. 403). Bethany (1931) and Wilton (1931). Not definite as to form.

CLADONIA CRISTATELLA f. BEAUVOISII (Del.) Vainio (p. 405). Essex (1931), Lyme (1931), Old Lyme (1930), Old Saybrook (1931), and Suffield (*Musch & Evans*, 1930).

<sup>7</sup> Acta Soc. F. et Fl. Fennica 14<sup>1</sup>: 79. 1897.

<sup>8</sup> See RHODORA 33: 154. 1931.



CLADONIA CRISTATELLA f. VESTITA Tuck. (p. 407). Bethany (1931), Granby (*Musch & Evans*, 1930), Lyme (1931), Old Lyme (1931), and Old Saybrook (1931).

CLADONIA CRISTATELLA f. SQUAMOSISSIMA Robbins (p. 408). Madison (1931) and North Branford (1931).

CLADONIA CRISTATELLA f. PLEUROCARPA Robbins (p. 408). Essex (1931), Lyme (1931), New Haven (1931), and North Branford (1931).

CLADONIA CRISTATELLA f. SQUAMULOSA Robbins (p. 410). New Haven (1931) and North Haven (1931).

\*CLADONIA INCRASSATA Floerke, *Clad. Comm.* 21. 1828. *C. cristatella* var. *paludicola* Tuck. *Syn. N. Am. Lich.* 1: 255. 1882. *C. paludicola* Merrill, *Bryologist* 27: 23. 1924.

On decaying wood or peaty soil. Bethany (1931), Lyme (1931), Madison (1931), North Branford (1931), North Haven (1931), and Wallingford (1931). Previously reported (p. 410, under *C. paludicola*) from Canterbury, Chester, East Hampton, Ledyard, and Stafford.

Although the validity of *C. paludicola* is recognized in the writer's report (p. 410), its close relationship to *C. incrassata* is suggested. Some of the specimens listed above, especially those from Bethany, are unusually luxuriant and give a better idea of *C. paludicola* than the material previously examined. These specimens have been carefully compared with the representative series of *C. incrassata* in Sandstede's *Cladoniae Exsiccatae* and fail to bring out any essential differences between them. According to the published descriptions the podetial cortex of *C. incrassata* is sometimes more or less soresiose, while nothing is said about soresiose podetia in the descriptions of *C. paludicola*. This seems to be the most important distinction indicated, but it is not constant. Whitish soresiose areas on the podetia can occasionally be demonstrated in North American specimens of *C. paludicola*, even if their occurrence is less frequent than in European specimens of *C. incrassata*. It therefore becomes necessary to reduce *C. paludicola* to synonymy. The known range of the species in Europe extends from Sweden and the British Isles to Austria and Italy. It has been found also in Kamchatka.<sup>9</sup>

\*CLADONIA INCRASSATA f. **squamulosa** (Robbins) comb. nov. *C. paludicola* f. *squamulosa* Robbins in *Evans*, *Trans. Connecticut Acad.* 30: 412. 1930. *C. incrassata* m. *phyllocephala* Sandst. in *Rabenhorst, Kryptogamen-Flora* 9, Abt. 4<sup>2</sup>: 150. 1931.

On decaying wood. Bethany (1931) and North Haven (1931). Previously reported from Old Saybrook (p. 412, as *C. paludicola* f. *squamulosa*).

<sup>9</sup> See Savicz, *Repert. Spec. Nov. Regni Veg.* 19: 344. 1924



## Section OCHROPHAEAE

## Subsection UNCIALES

Only two species of the Unciales, *C. uncialis* and *C. Boryi*, are recognized in the Cladoniae of Connecticut, but a third species, *C. caroliniana*, is well represented in the flora of the State. This species, which has not been well understood by students of the genus, occupies a position between *C. uncialis* and *C. Boryi*, and certain specimens of *C. caroliniana* are listed under one or the other of these two names in the writer's report. When Tuckerman, in 1858, first published the species he found it "difficult to indicate satisfactory characters to distinguish it from extreme, or at least possible states of *C. uncialis* var. *turgescens*, Schaer.," and yet he believed "the two to be quite distinct plants." Later on he changed his opinion about it and, in 1882, described it as a variety of *C. uncialis*. Vainio also was in doubt about the validity of *C. caroliniana* as a species and, without having seen authentic specimens, listed it in his Monograph as a subspecies under *C. uncialis*. Merrill, on the other hand, in his Lichenes Exsiccati, and Zahlbruckner, in his Catalogue, did not hesitate to give *C. caroliniana* full specific rank. From the study of abundant material the writer is convinced that the claims of the species for recognition are well founded, in spite of the fact that certain juvenile stages bear a strong resemblance to analagous stages of *C. uncialis*. The Connecticut representatives of the Unciales may be distinguished by the following key:—

Podetia firm in texture, yellowish gray to yellowish or brownish green; podetial wall continuous or with clearly defined axillary or internodal perforations; cortex distinct and continuous (or subcontinuous), the outer podetial surface tending to be smooth.

Podetia pale yellowish green to brownish green, cupless; axillary perforations more or less numerous on both sterile and fertile plants; inner medullary (or cartilaginous) layer distinct and usually continuous, the inner podetial surface uniform. . . . . *C. uncialis*.

Podetia yellowish gray to pale yellowish green, usually cupless but occasionally with shallow cups; axillary perforations lacking (or exceedingly rare) on sterile plants, present on fruiting plants; inner medullary (or cartilaginous) layer not distinct, represented by irregularly distributed strands of hyphae, the inner podetial surface showing a vague network.

*C. caroliniana*.

Podetia delicate in texture, cupless or with more or less definite cups, ashy gray, sometimes faintly tinged with yellowish; podetial wall in the older parts usually irregularly perforated and sometimes reticulate; axillary perforations more or less numerous; cortex scarcely differentiated, the outer podetial surface



dull but not arachnoid; inner medullary layer somewhat as in *C. caroliniana* but the strands of hyphae still more scattered, the inner podetial surface showing a looser and more distinct network.....*C. Boryi*.

*C. UNCIALIS* (L.) Web. (p. 413). Granby (*Musch & Evans*, 1930), Lyme (1930, 1931), Old Lyme (1930), Suffield (*Musch & Evans*, 1930), Wallingford (1931), and Wilton (1930).

The stramineous tinge of *C. uncialis* is usually very distinct, the color varying from a pale yellowish green to brownish greens of different shades. Sometimes, especially in old herbarium specimens, the podetia are straw-colored, with little or no indication of green to the naked eye, but even in these the irregular green areolae become evident under the lens. These areolae, especially in actively growing plants, stand out clearly and are separated from one another by paler bands or lines. They sometimes project as low verruculae but often do not project at all. In either case the outer podetial surface presents a smooth appearance, since the cortex covers both the areolae and the spaces between. Sometimes a slight glossiness is apparent.

Although the podetia of *C. uncialis* are exceedingly irregular in their branching, especially when the various forms are taken into consideration, it is not difficult to see that they exhibit a succession of dichotomies or polytomies or both. In other words the irregularity of the branch-systems is not increased to any great extent by the appearance of short branches or outgrowths additional to the main branches. In this respect *C. uncialis* is distinguished from the more robust forms of *C. caroliniana*. Most of the descriptions of *C. uncialis* emphasize the pointed and pigmented tips of the ultimate branchlets. These are sometimes very much in evidence and perhaps represent a response to intense insolation. They are smooth or even glossy, varying in color from dark to blackish brown, and are sometimes bristle-like in appearance. In other cases deeply pigmented tips are difficult to demonstrate and may be absent altogether. Under these circumstances the tips may vary in color from whitish or yellowish to pale brown.

Axillary perforations are sometimes present in abundance and are sometimes few and far between. Vainio, in fact, described a f. *integerrima*<sup>10</sup> in which the axils were said to be always closed, and this form is recognized by both Anders and Sandstede. It is doubtful,

<sup>10</sup> Acta Soc. F. et Fl. Fennica 4: 270. 1887.



however, whether perforations are ever completely lacking in a colony of any size, and the writer has been able to demonstrate their presence in all the material of *C. uncialis* at his disposal, with the exception of a single small colony. Even the four specimens in Sandstede's Exsiccati, Nos. 155, 300, 444, and 553, which he cites somewhat provisionally under f. *integerrima*,<sup>11</sup> show occasional perforations. It seems justifiable, therefore, to consider the presence of axillary perforations as a definite specific character of *C. uncialis*, even if many axils remain imperforate. Axils of this type are found especially in dichotomies and are therefore most frequent in young plants or in plants which have persisted in a juvenile stage of development. In robust specimens, especially where the branching is largely polytomous in character, closed axils are relatively rare. The axillary perforations vary in size from the merest pin-points to large and distinct openings. In rare cases similar perforations are present in the internodal podetial walls.

Vainio, in his Monograph, gives a clear description of the podetial wall in *C. uncialis*. According to his account the wall, in spite of its firmness, is relatively thin, measuring only 0.1–0.2 mm. in thickness. The well-differentiated cortex consists of thick and closely united subvertical hyphae and is 30–40  $\mu$  thick. The inner medullary (or cartilaginous) layer, which is not sharply delimited from the outer layer, is 30–80  $\mu$  thick and composed of similar thick, coalesced hyphae, sometimes jelly-like in appearance, with only the lumina distinct. Between these two layers the outer medullary layer, which encloses the algal cells among its finer and more loosely interwoven hyphae, is situated. Vainio's description applies to the podetia studied by the writer, except that the line of demarcation between the two medullary layers is perhaps more definite than the description implies. It is, to be sure, a wavy irregular line as seen in cross-sections, since strands of coalesced hyphae bulge into the outer layer, but these strands are united to form a continuous layer around the central podetial cavity and apparently never bulge far enough to reach through the outer layer to the cortex. When the cartilaginous layer is examined from the inside under the lens it presents a smooth and uniform appearance, sometimes slightly pulverulent, although the inner boundary in cross-section forms a somewhat irregular line.

Five forms of *C. uncialis* are listed in the writer's report, and many

<sup>11</sup> In Rabenhorst, *Kryptogamen-Flora* 9, Abt. 4<sup>2</sup>: 186. 1931.



others have been described in the literature. Some of these forms, as in other species of *Cladonia*, are based on fairly satisfactory characters, while others are based on vague, inconstant, and intergrading characters. This becomes evident from the study of published descriptions and from the examination of specimens in exsiccati assigned to definite forms. One consequence of this condition is that a given specimen can sometimes be referred to either one of two forms. Sandstede, for example, states that No. 553 of his exsiccati, which he first lists under f. *dicraea*, might be referred to f. *integerrima*, and that Nos. 155, 300, and 444, which he first lists under f. *integerrima*, might be referred to f. *setigera*. In some cases, therefore, the citation of a specimen under a definite form may be largely a matter of convenience and need not always indicate that the form in question is a definite taxonomic unit. This will apply to some of the specimens listed below.

CLADONIA UNCIALIS f. SUBOBTUSATA Coem. (p. 416). Old Lyme (1930).

The distinctive features of this form are two: large axillary perforations and hair-like "rhizinae," varying in color from whitish to blackish. These features are shown clearly by the plants from Old Lyme. Most of the specimens previously listed by the writer, however, although producing rhizinae in considerable abundance, have most (if not all) of their axils imperforate. They should be referred, in fact, not to *C. uncialis* at all but to *C. caroliniana* and are listed below under that species.

CLADONIA UNCIALIS f. DICRAEA (Ach.) Vainio (p. 416). Lyme (1931, det. Sandstede).

CLADONIA UNCIALIS f. SPINOSA Oliv. (p. 417). Shelton (1928, det. Sandstede, not previously reported).

\*CLADONIA UNCIALIS f. TURGESSENS (Del.) Fr. Lich. Eur. Ref. 244. 1831 (as *C. uncialis* c. *turgescens*). *Cenomyce uncialis*  $\eta$ . *turgescens* Del. in Duby, Bot. Gall. 620. 1830.

On earth over rocks, Old Lyme (1930, det. Sandstede).

The podetia of f. *turgescens* are characterized by their large size and relatively sparse branching. According to Sandstede f. *biuncialis* (Hoffm.) Harm. (p. 417) should be included under f. *turgescens*.

\*CLADONIA UNCIALIS f. POLYCRAEA (Floerke) Sandst. Clad. Exsic. Bericht. Uebersicht 44. 1930; Rabenhorst, Kryptogamen-Flora 9, Abt. 4<sup>2</sup>: 185. 1931. *C. stellata* var. *polycraea* Floerke, Comm. Clad. 174. 1828.

On earth over rocks, Old Lyme (1930, det. Sandstede). Apparently the first record for North America.



This plant is not formally described by Sandstede; he simply refers several specimens which he lists under "fruchtende Pflanzen" to "polycraea Floerke." Their characteristic features are found in the ultimate branches, many of which show apical perforations surrounded by whorls of very short, brownish, radiating branchlets. These branchlets are usually simple but may be minutely branched at the tips.

\*CLADONIA UNCIALIS f. SETIGERA Anders, Mitt. Nordböhm. Ver. Heimatsforsch. und Wanderpflege **40**: 70. 1917; Hedwigia **61**: 362. 1920.

On rocks. Clinton (1927, not previously reported), Greenwich (1931), Lyme (1930), and Wilton (1931). The specimen from Clinton was determined by Robbins as "near f. *setigera*;" the other three specimens were determined by Sandstede. Not before reported from North America.

In the present form, which seems to be always sterile, the podetia scarcely advance beyond a juvenile stage of development. The slender axes are usually less than 1 mm. in diameter, the dichotomies (or trichotomies) come in close succession, and the podetial surface is usually verruculose or rugulose. The form is further distinguished by the long terminal branches, which are often variously curved and occasionally tipped with one or more blackish fibrils, or rhizinae. The plants, in their typical development, form compact and often pulvinate colonies. According to Anders the axils are perforate, but colonies sometimes occur in which imperforate axils are greatly in the majority. Such colonies, as we have seen above, have been provisionally referred to f. *integerrima* by Sandstede.

\*CLADONIA CAROLINIANA (Schwein.) Tuck. Am. Jour. Sci. Arts **25**: 427. 1858. *Cenomyce caroliniana* Schwein. in Tuckerman, *l. c.* (as synonym). *Cladonia uncialis* \*\**C. caroliniana* Nyl. Syn. Lich. 216. 1860. *C. uncialis* c. *caroliniana* Tuck. Syn. N. Am. Lich. **1**: 251. 1882.

The podetia of *C. caroliniana*, as a rule, grow in large and irregular colonies and sometimes bear a strong resemblance to those of *C. uncialis*. There are, however, a number of differences between them, and certain of these usually make it possible to distinguish between the species in the field. The differences can perhaps be brought out most clearly by comparison.

In *C. uncialis*, as has been shown, the stramineous tinge is usually very apparent; in *C. caroliniana* it tends to be much less marked, so that the color is often grayish green rather than yellowish. Even when a yellowish tint is present the color remains pale and apparently



never approaches deep yellowish or brownish shades. The differences in color show as well in dry material as in moist and are especially striking when the two species grow side by side. In actively growing plants, moreover, the green areolae of *C. caroliniana* usually stand out less clearly than those of *C. uncialis* and merge more gradually into the intervening bands or lines. In most cases the areolae project very slightly or not at all, but the podetial surface although fairly uniform appears less smooth than in *C. uncialis* and is dull rather than glossy.

The branching of the podetia in *C. caroliniana* yields some of the most distinctive characters of the species. Although a dichotomous or polytomous type is more or less apparent in juvenile stages and in the larger axes of robust plants, the podetia usually show numerous small branches or short and irregular outgrowths which can be referred only with difficulty to dichotomies or polytomies. The tendency to form these irregular structures is especially marked toward the apices of well-developed podetia. In many cases the tips of the main branches are inflated and exceedingly complex, the short wart-like or rod-like branchlets diverging in all directions. They are sometimes simple and sometimes variously subdivided. Occasionally, especially in fruiting material, apical whorls of branchlets are formed. In such cases the apex of a larger branch may broaden out into a flat circular expansion, which bears at its periphery a series of short radiating branchlets, sometimes sterile and sometimes tipped with apothecia. These apical expansions, when at all regular, might be described as shallow cups. Although the tips of the branches in *C. caroliniana* are sometimes pointed, much as in *C. uncialis*, they are usually much paler and apparently never show a dark brown or blackish pigmentation. Even when the tips are pale brown in color the surface remains dull and may be covered with a vague bloom.

Although the podetia of *C. caroliniana* occasionally show a very few internodal openings, similar to those of *C. uncialis*, they apparently never form axillary perforations in their younger stages, and the absence of such perforations is emphasized by Sandstede in his remarks on the species.<sup>12</sup> In mature plants, however, axillary perforations are sometimes present, and this is particularly true of plants with apothecia. The perforations are most frequently present in

<sup>12</sup> In Rabenhorst, *Kryptogamen-Flora* 9, Abt. 4<sup>2</sup>: 193. 1931. The remarks apply to No. 1471 of his exsiccati, which is labeled "Cl. uncialis (L.) Web. \*Caroliniana (Schwein.) Tuck."



the cup-like apical expansions surrounded by whorls of branchlets. The species, therefore, can produce axillary perforations upon occasion. In spite of this fact the majority of specimens fail to show them and can thus be distinguished from the usual forms of *C. uncialis*.

The podetial wall in *C. caroliniana*, although a trifle less firm than in *C. uncialis*, usually measures 0.15–0.25 mm. in thickness. The cortex, as seen in cross-section, is separated from the medulla by a wavy line and presents the appearance of being more or less broken up into strands. These strands, however, are so closely contiguous that they form a subcontinuous layer, about as thick as the cortex of *C. uncialis*. The inner medullary layer is very different from that of *C. uncialis*. Its cartilaginous elements, instead of forming a definite continuous or subcontinuous layer, are grouped together in separate strands, which vary considerably in diameter. Some of these strands lie next to the podetial cavity, but others are found in various parts of the medullary layer, and it is not unusual for occasional strands to lie in contact with the cortex itself. The strands lying next to the podetial cavity are more numerous than elsewhere and are sometimes in contact, but there are always spaces not occupied by strands, and these are filled with the loosely interwoven hyphae characteristic of the outer medullary layer. When the podetial wall is examined from the inside the strands are visible as narrow or broad smooth bands, forming an irregular network, and the meshes of the network present a rough or even arachnoid appearance. This is shown particularly well when larger podetia are split open and examined dry under a lens.

The histological structure of *C. caroliniana* is very much like that of the European *C. destriata* Nyl. This species, too, was long confused with *C. uncialis*, and it is only recently that its validity has been widely recognized. In his description of the podetial wall Vainio<sup>13</sup> states that a definite cartilaginous layer is not differentiated in the medulla but that strands of thick-walled, agglutinated hyphae are mixed with the looser elements characteristic of the outer layer. It will be seen that this account is in essential agreement with the account given above. *C. destriata* agrees with *C. caroliniana* further in its color, which rarely shows indications of yellow, and in its axils, which are almost always imperforate.

In all probability, however, the two species are distinct. In the

<sup>13</sup> Acta Soc. F. et Fl. Fenn. 53: 45. 1922. Vainio describes the species under the name *C. Zopfi*.



usual robust forms of *C. dextrata*, for example, the podetia show definite dichotomies and polytomies, and it is only in such types as f. *scyphosula* Sandst.<sup>14</sup> that the more complex conditions found in *C. caroliniana* are approached. The color in *C. dextrata*, moreover, is usually a darker gray than in *C. caroliniana*, and Sandstede states that dry plants show a bluish tinge. He ascribes this to the presence of dextratinic acid, an indigo-blue substance isolated and described by Zopf.<sup>15</sup> The blackish spermagonia of *C. dextrata*, where this substance is deposited in concentrated form, are often produced in abundance, but the brownish apothecia are exceedingly rare. In *C. caroliniana*, on the other hand, spermagonia are apparently rarely produced, while apothecia have been observed in specimens from widely separated localities. The chemical composition of *C. caroliniana* has not yet been investigated.

According to available information *C. caroliniana* is a species of the eastern United States, with a range extending from Maine to Florida. It grows on earth over rocks and on sandy soil, sometimes in open pine woods. The following forms may be recognized, although the lines of demarcation separating them are not always sharply defined:

Podetia without adventive outgrowths (except perhaps toward the tips).

Podetia more or less dilated upward, sometimes irregularly inflated, usually 1–2 mm. wide but occasionally attaining a diameter of 3–4 mm. or even more.

Branches often tipped with subcircular, cup-like expansions bordered by whorls of radiating branchlets.

f. *dimorphoclada*.

Branches variable in the upper part, with irregular rod-like or wart-like outgrowths.

Rhizinae lacking.....f. *dilatata*.

Rhizinae more or less abundant.....f. *fibrillosa*.

Podetia more or less regularly dichotomously or polytomously branched, rarely exceeding 1 mm. in diameter and often considerably less.....f. *tenuiramea*.

Podetia with more or less abundant adventive outgrowths, especially toward the base.....f. *prolifera*.

\*CLADONIA CAROLINIANA f. **dimorphoclada** (Robbins) comb. nov.  
*C. dimorphoclada* Robbins in Sandstede, Clad. Exsic. 1882. 1929.

On earth over rocks, Lyme (1931).

The original specimens of *C. dimorphoclada* were collected by the writer at Wrightsville, North Carolina, in 1928. In the short diagnosis printed on the label of No. 1882 the podetial branches are said to

<sup>14</sup> Abhandl. Naturw. Ver. Bremen 25: 154. 1922.

<sup>15</sup> See Flechtenstoffe 331. 1907.



be minutely but manifestly cup-forming at the tips or else minutely furcate-subulate, this difference being indicated by the specific name. When Dr. Sandstede examined the specimens from Lyme he noted their resemblance to the Wrightsville specimens and wrote that they could be "die vollendete Form von *Cl. dimorphoclada* Robb." The writer feels convinced that this view is correct. At the same time the specimens from Lyme are clearly very close to some of the specimens of *C. caroliniana* noted below, where occasional branches approach a cup-like condition. It seems advisable, therefore, to include *C. dimorphoclada* among the forms of *C. caroliniana*. In the majority of cases the membranes of the cups are closed, but occasionally a central perforation can be demonstrated.

\*CLADONIA CAROLINIANA f. **dilatata** f. nova, podetia parte superiore varie dilatata aut bullata, ascypha, ramulis brevibus, plerumque verruciformibus, axillis fere omnibus clausis, rarissime perviis.

In sandy soil and on earth over rocks. Branford (1921, 1928, listed as *C. Boryi*, in part as ff. *lacunosa* and *prolifera*), Clinton (1927), Essex (1931), Killingworth (*Hall*, 1874, listed as *C. uncialis* f. *subobtusata*), Madison (1927), North Branford (1931), Old Lyme (1930), Old Saybrook (*Musch & Evans*, 1928), Saybrook (*Musch & Evans*, 1928), Wallingford (1931), and Westbrook (1927). Unless otherwise indicated the specimens dated 1928 or earlier are listed in the writer's report under *C. uncialis*.

Under the present form the writer would include most of the more robust specimens of *C. caroliniana*. They are characterized not only by their greater size but by the numerous short and irregular branchlets that are given off, more especially in the apical portions. In extreme cases the tips of the main axes are conspicuously swollen, but the increase in size upward is often less marked and more gradual. In some cases the branches are more or less flattened. In fruiting material the short branchlets tipped with apothecia are either simple or sparingly subdivided. They are usually irregularly distributed but sometimes show a tendency to be arranged in more or less crowded whorls around the expanded tip of a larger branch, and under these circumstances the apical expansion is occasionally perforate. Even when whorls of branchlets are present, however, the expansions are too irregular and indefinite to be considered cups. The apothecia vary in color from pale to dark brown. The following four specimens, distributed in exsiccati, should be referred to f. *dilatata*: Merrill, Lich. Exsic. 25, collected in 1923 by P. O. Shallert at Winston-Salem, North Carolina; Lich. Exsic. 233 (as *C. uncialis* f. *obtusata*),



collected in 1911 by C. C. Plitt in Baltimore County, Maryland; Zahlbruckner, *Krypt. Exsic. Mus. Vindobon.* 2775, collected by C. C. Plitt in the same region; and Sandstede, *Clad. Exsic.* 1471, collected in 1924 by G. K. Merrill at Rockland, Maine.

\*CLADONIA CAROLINIANA f. **fibrillosa** f. nova, podetia eis f. *dilatatae* similia, sed ramulis pro parte rhizinis albidis, cinerascentibus aut obscuratis instructis.

On earth over rocks. Bethany (*Eaton*, 1875), Branford (1921), Middletown (*Wright*, 1883), and New Haven (*Eaton*, 1855). These specimens are listed (p. 416) under *C. uncialis* f. *subobtusata*; the Middletown specimens, which include a few podetia of the true *C. uncialis* f. *subobtusata*, are listed also under *C. uncialis* (p. 413).

The rhizinae or fibrils, which characterize the present form, are sometimes abundant and sometimes very sparingly produced. In most cases they occur singly or in small clusters at the tips of subulate branchlets, and their color varies from whitish or pale gray to dark brown or blackish. Except for the presence of the rhizinae f. *fibrillosa* is essentially like f. *dilatata*.

\*CLADONIA CAROLINIANA f. **tenuiramea** f. nova, podetia tenuia, subcylindrica, ascypha, dichotome aut polychotome ramosa, apicibus vulgo attenuatis, axillis clausis, ramulis adventiciis raris nullisve.

On earth over rocks and in sandy fields. Bolton (1927), Clinton (1927), Ledyard (1925), Madison (1927, 1928), New Hartford (1928), North Haven (1927), Old Lyme (1927), and Old Saybrook (*Musch & Evans* 1928; *Evans*, 1931). These specimens, except the last, are listed (p. 413) under *C. uncialis*, in part (p. 416) under f. *dicraea*.

The colonies of f. *tenuiramea*, although sometimes extensive, represent a condition in which the podetia have scarcely advanced beyond a juvenile stage of development and thus fail to show some of the most characteristic features of the species. The slender branches, for example, instead of increasing upward, tend to narrow gradually, and the distinctive wart-like or rod-like branchlets are either absent altogether or sparingly produced. In most respects the form is analogous to *C. uncialis* f. *setigera*, but the paler color and closed axils will usually serve to distinguish it. In doubtful cases a cross-section of the podetial wall will show the characteristic scattered strands of cartilaginous hyphae in the medullary layer.

\*CLADONIA CAROLINIANA f. **prolifera** f. nova, podetia vulgo decumbentia, in partibus et inferioribus et superioribus ramulis adventiciis brevibus plus minusve numerosis tecta.

Beacon Falls (1928), Branford (1928), Clinton (1927), East Haven (1927), Essex (1927, 1931), Litchfield (1927), Lyme (1931), Madison



(1927, 1931), North Branford (1931), North Haven (1927, 1931), Old Lyme (*Musch & Evans*, 1926), and Wallingford (1931). Of the specimens dated 1928 or earlier, those from Beacon Falls, Branford, and Old Lyme are listed (pp. 417 and 419) under *C. Boryi*, mostly under f. *prolifera*; while those from other localities are listed under *C. uncialis* (p. 413), in one case under f. *dicraea*.

The proliferous form of *C. caroliniana* is analogous to *C. uncialis* f. *spinosa* and the proliferous conditions of the Cladinae. It represents a response to external factors, rather than a true form in the taxonomic sense, and is to be looked for in unfavorable situations where the apical growth has been inhibited in some way. In most of the specimens listed the podetia are still in a juvenile stage of development but have reached, in a few cases, a more advanced stage, comparable with f. *dilatata*.

CLADONIA BORYI Tuck. (p. 417).

The colonies of *C. Boryi* are large and irregular, much as in the usual forms of *C. uncialis* and *C. caroliniana*, but the podetia present a more delicate appearance and often look as if they were badly weathered. The color is usually a dull, ashy gray, with only slight indications of yellowish or greenish tints, but may become dark gray or blackish with age. The podetia are usually larger than in the two preceding species and are often 3-4 mm. in diameter. They branch irregularly and rather sparingly, but the branching in most cases is by definite dichotomies or polytomies. In many specimens there is little or no approach to cup-formation. In well-developed material, however, the main branches are often expanded at the tip, the expanded portion being surrounded by a whorl of suberect or divergent branchlets and thus constituting a more or less definite cup. The membrane of the cup, although sometimes closed, is often irregularly perforate or cribose; and the branchlets, which are occasionally simple, are usually subdivided and are sometimes tipped with minute cups surrounded by very tiny branchlets. The apical portions of the ultimate branchlets are usually more or less pigmented with brown. Aside from the perforations of the cups, the regular podetial axils may also be perforate, although closed axils are not infrequent. The wall bears besides occasional internodal openings, similar to those described for *C. uncialis* and *C. caroliniana*, and tends to become irregularly cribose with age.

The podetial surface is dull but not arachnoid. In young plants it may be smooth, but it is usually verruculose, the verruculae being



formed by projecting groups of algal cells. The outlines of these groups, however, can scarcely be distinguished, owing to the opacity of the outermost layer of the podetial wall. In older parts of the podetia, the tissues separating the verruculae break down more or less completely and thus give rise to the cribose condition.

Vainio, in his description of the podetial wall, states that the cortex and the cartilaginous layer of the medulla are both lacking.<sup>16</sup> The wall would thus consist of the outer medullary layer only. This layer, according to his account, consists of loosely interwoven hyphae and scattered strands of united hyphae. The groups of algal cells are situated in meshes formed by the loosely interwoven hyphae and are found in the inner parts of the wall as well as in the outer. A cross-section of the wall, which is usually 0.2–0.3 mm. thick, confirms this description, except for the fact that the wall is bounded on the outside by a more or less definite layer of thick-walled hyphae. These hyphae, which are mostly 8–12  $\mu$  in diameter, are somewhat coarser than the interior hyphae, which are usually only 4–6  $\mu$  in diameter. The thick-walled hyphae extend in all directions and are closely interwoven without being compactly united. They form a protective layer, even if this layer is too loosely constructed to be described as a cortex. It should be noted also that the algal cells are most abundant just within this protective layer, the more deeply situated groups being widely scattered. The strands of agglutinated hyphae, which represent the essential elements of a cartilaginous layer, are fewer and more widely separated than in *C. caroliniana* and are usually smaller in diameter. Although scattered throughout the thickness of the wall they are more numerous in the vicinity of the podetial cavity. When the wall of a dry podetium is examined from the inside under a lens, the strands show distinctly and form an irregular, lace-like network, far more delicate than that of *C. caroliniana*.

Two forms of *C. Boryi*, f. *lacunosa* and f. *prolifera*, have been recorded for Connecticut (pp. 418 and 419), but several of the records for f. *prolifera* are transferred above to *C. caroliniana* f. *prolifera*. The specimens listed below include two additional forms of the species.

CLADONIA BORYI f. LACUNOSA (Bory) Tuck. (p. 418). North Branford (1931).

\*CLADONIA BORYI f. RETICULATA (Russell) Merrill, Bryologist 12: 92. 1909. *C. uncialis* var. *reticulata* Russell, Jour. Essex Nat. Hist. Soc. 1: 100. 1839.

<sup>16</sup> Acta Soc. F. et Fl. Fennica 4: 281. 1887.



In sandy soil or on earth over rocks. North Branford (1931), Old Lyme (1930), and Old Saybrook (1931).

The present form, which represents the species in its most typical development, is characterized by the presence of more or less definite cups.

\*CLADONIA BORYI f. **cribrosa** (Del.) comb. nov. *Cenomyce lacunosa* γ. *cribrosa* Del. in Vainio, Acta Soc. F. et Fl. Fenn. **4**: 282. 1887. *Cladonia reticulata* f. *cribrosa* Vainio, *Ibid.* **10**: 466. 1894.

On sandy soil, Old Saybrook (1931).

The specimens here listed are made up of old and prostrate, robust podetia, in which the cribrose condition shows with remarkable clearness. A few of the branchlets show small apical clusters of the rhizinae which Vainio emphasizes in his description, but these are by no means conspicuous.

(To be continued)

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## PHYMOSIA REMOTA

P. D. STRAUSBAUGH and EARL L. CORE

ON the third day of August 1927, the members of the West Virginia University Botanical Expedition discovered *Phymosia remota* growing on the slopes of Peters Mountain about 1½ miles below the village of The Narrows in Giles County, Virginia. At this point the New River has cut a huge gap across the mountain completely dividing it into East River Mountain on the west and Peters Mountain on the east; therefore the station where the plants were found lies on the east side of the river and at an elevation of approximately 2000 feet, or 500 feet above the level of the stream. As this represents a most remarkable extension of the range of this species which has previously been "known only from a gravelly island in the Kankakee River, Illinois,"<sup>1</sup> the writers were tempted to make a thorough study of the taxonomy of the species. The available literature clearly reveals that considerable difficulty has attended the delimitation and naming of the species and therefore a brief history of the taxonomy will be given.

The genus *Sphaeralcea* was established by A. St. Hilaire<sup>2</sup> in 1827. Two years prior to that date, however, Desvaux<sup>3</sup> had created the genus

<sup>1</sup> Robinson, B. L., and M. L. Fernald. Gray's New Manual of Botany, 7th ed. p. 566. 1908.

<sup>2</sup> Flora Brasiliae Meridionalis **1**: 209. 1827.

<sup>3</sup> Desvaux in Hamilton, Prodromus Flora Ind. Occ. 49. 1825.